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(71)Applicant : MITSUBISHI CHEMICALS CORP

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(72)Inventor : MATAGA SHUNTARO
GOROMARU HIDETAKA
THIES THIEMANN
KADOWAKI MASAMI
MAEDA SHUICHI

(30)Priority

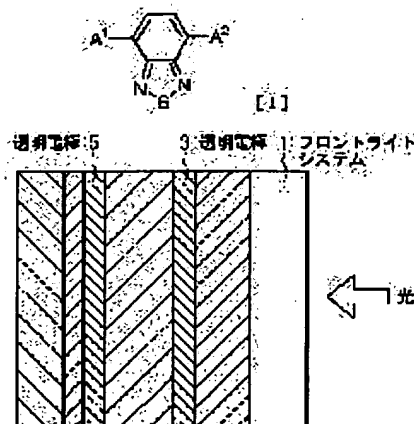
Priority number : 2001223320 Priority date : 24.07.2001 Priority country : JP

(54) BENZOTHIADIAZOLE DERIVATIVE, LIQUID CRYSTAL COMPOSITION,
WAVELENGTH-CONVERTING ELEMENT, ELECTROLUMINESCENT ELEMENT,
ELECTRIC CHARGE TRANSPORTATION MATERIAL AND PHOTOELECTRIC TRANSFER
ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a new fluorescent benzothiadiazole derivative exhibiting high dichroism and solubility and useful for various elements such as display elements, e.g. liquid crystal elements or electroluminescent elements, wavelength- converting elements or photoelectric transfer elements, a liquid crystal composition using the derivative and various elements.

SOLUTION: The benzothiadiazole is represented by the



general formula (I) (A1 and A2 are each independently phenyl group, an alkoxyphenyl group or the like). The liquid crystal composition is obtained by using the benzothiadiazole derivative. The liquid crystal display element, the wavelength- converting element, the electroluminescent element, the electric charge transportation material and the photoelectric transfer element are also provided.

LEGAL STATUS

[Date of request for examination] 08.10.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

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[Date of registration]

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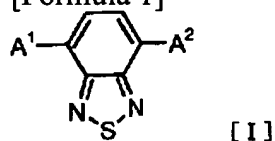
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CLAIMS

[Claim(s)]

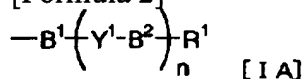
[Claim 1] The benzothiadiazole derivative expressed with the following general formula [I].

[Formula 1]

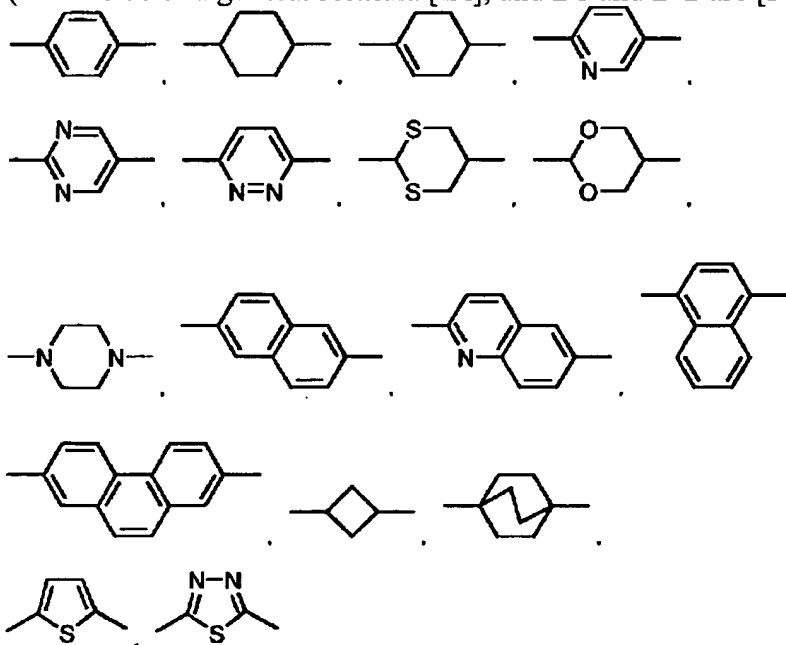


(A1 and A2 show independently the radical expressed with the following general formula [IA] among a [general formula I] type, respectively.)

[Formula 2]



(The inside of a general formula [IA], and B1 and B-2 are [Formula 3] independently, respectively.)

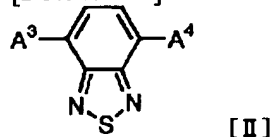


Each of examples and these may have a fluorine atom, a chlorine atom, a bromine atom, a methyl group, the methoxy group, the hydroxyl group, the cyano group, or the nitro group as a substituent. Y1 shows direct coupling or -COO-, -OCH2-, -CH=N-, -CH=CH-, -C**C-, -O-, -COS-, -CON-, or -N=N-. n shows 0 or 1. The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20

by which R1 may be permuted by the halogen atom, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, either of the alkylthio groups of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching, the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching is shown.)

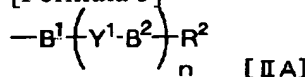
[Claim 2] The liquid crystal constituent characterized by including at least one or more sorts of benzothiadiazole derivatives expressed with the following general formula [II].

[Formula 4]



(A3 and A4 show independently the radical expressed with the following general formula [IIA] among a general formula [II], respectively.)

[Formula 5]



(B1, B-2, and Y1 and n are synonymous also in a general formula [IA] among a general formula [IIA].

R2) The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the hydrogen atom, the halogen atom, and the halogen atom, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, either of the alkylthio groups of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching, the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching is shown.)

[Claim 3] The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 by which R2 may be permuted by the halogen atom in said general formula [IIA], and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, The liquid crystal constituent according to claim 2 characterized by being the alkylthio group of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching or the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching.

[Claim 4] The liquid crystal constituent according to claim 2 or 3 characterized by containing at least one or more sorts of benzothiadiazole derivatives which are expressed with said general formula [II], and have liquid crystallinity.

[Claim 5] The liquid crystal display component characterized by at least one side pinching a liquid crystal constituent given in claim 2 thru/or any 1 term of 4 between transparent electrode substrates.

[Claim 6] The wavelength sensing element by which it is using [for a benzothiadiazole derivative according to claim 1 or claim 2 thru/or any 1 term of 4]-liquid crystal constituent of publication characterized.

[Claim 7] The electroluminescent element by which it is using [for a benzothiadiazole derivative according to claim 1 or claim 2 thru/or any 1 term of 4]-liquid crystal constituent of publication characterized.

[Claim 8] The charge transport ingredient characterized by using the liquid crystal constituent of a publication for a benzothiadiazole derivative according to claim 1 or claim 2 thru/or any 1 term of 4.

[Claim 9] The optoelectric transducer by which it is using-charge transport ingredient according to claim 8 characterized.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the liquid crystal constituents using a benzothiadiazole derivative useful for various components, such as display devices, such as a liquid crystal device and an electroluminescent element, a wavelength sensing element, and an optoelectric transducer, and this derivative, and these applications.

[0002]

[Description of the Prior Art] Many liquid crystal display methods are proposed as a display device of an information terminal equipment until now. The liquid crystal constituent and liquid crystal display component which contained the fluorescence matter in it are indicated by JP,53-133460,A, JP,63-503073,A, etc.

[0003] On the other hand, the light weight, the thin shape, and the reflective mold liquid crystal display component of a low power attract attention as a portable nonluminescent mold display for information-machines-and-equipment terminals. In the reflective mold liquid crystal device which does not have source equipments of a fill-in flash, such as a back light, the brighter liquid crystal display method is called for and the liquid crystal constituent and liquid crystal device containing the fluorescence matter relevant to the above-mentioned official report are indicated as an optical grant means to reinforce the brightness of a liquid crystal device (JP,5-142530,A, JP,9-258272,A, JP,2000-66245,A, etc.).

[0004] However, it has problems, like the fluorescence dichroism coloring matter used for the liquid crystal constituent and liquid crystal display component of these former, such as coumarins and cyanines, has the low solubility over a liquid crystal ingredient. Moreover, the dichroism of a fluorescent material is also low and has become the cause by which this causes the fall of the brightness in the absorption wavelength field of coloring matter. Moreover, similarly, since it was low, the lightness at the time of which black dark color display went up, and reservation of sufficient contrast ratio was difficult for the luminescence dichroism by optical pumping which is the key objective of an optical grant means.

[0005] Furthermore, also in the wavelength sensing element used for laser oscillation equipment, a solar battery, etc., although what mixed the fluorescence matter into the liquid crystal ingredient was indicated by JP,6-318766,A etc., since the solubility and dichroism over the liquid crystal ingredient of the fluorescence matter were low like the above, it was difficult [it] to obtain sufficient light wave length conversion function. Thus, there was nothing that has sufficient solubility and sufficient dichroism in the fluorescence dichroism coloring matter used for the liquid crystal constituent used for a liquid crystal display component etc. as an additive.

[0006] Moreover, paying attention to the liquid crystallinity of the coloring matter which has absorption dichroism and fluorescence dichroism, the coloring liquid crystal (liquid crystal color) using coloring matter itself as a liquid crystal constituent is examined. For example, the foundation of liquid crystal, "application" Kogyo Chosakai Publishing (1991), and 148th page - the 149th page have instantiation of

an azo system compound, an azoxy series compound, etc., and J.Heterocyclic Chem., 29 and 87, and 87th page - the 92nd page (1992) have instantiation of a thiazole pyridazine system compound, a thiazole pyridine system compound, etc. However, the useful big dielectric anisotropy is not found out by the electro-optical effect of a liquid crystal device etc. in these compounds. First of all, a thiazole pyridazine system compound does not have fluorescence.

[0007] On the other hand, as a luminescence mold display display for information-machines-and-equipment terminals, the organic electroluminescent element (organic EL device) attracts attention, and development of the organic material which has the charge transportation function excellent in the electron hole transportation layer is called for. Moreover, the same outstanding charge transportation ingredient is called for also in development of the photo-electric-conversion ingredient used for a photocopying machine, a laser beam printer, etc., and an organic-semiconductor ingredient. The liquid crystallinity organic photo conductor and liquid crystallinity charge transportation ingredient which have liquid crystallinity as indicated by JP,6-194849,A, JP,11-144525,A, etc. as these solution approaches are examined. By giving liquid crystallinity to these ingredients, in an organic EL device, the process which was carrying out the laminating of a charge transportation layer and the luminous layer by the vacuum evaporation technique etc. is conventionally simplified by monolayer structure, or the functional improvement in the charge transportation ability by molecular orientation etc. is expected.

[0008] However, the number was conventionally restricted very much by constraint of the molecular structure [in / in the liquid crystallinity coloring matter which has liquid crystallinity, or a liquid crystallinity organic photo conductor and a liquid crystallinity charge transportation ingredient / a liquid crystallinity (meso gene) manifestation] etc.

[0009]

[Problem(s) to be Solved by the Invention] This invention aims at offering the new fluorescence benzothiadiazole derivative in which the bright display suitable for a reflective mold liquid crystal display component is possible, the liquid crystal constituent which contains this benzothiadiazole derivative as fluorescence matter, and the liquid crystal device using this.

[0010] This invention aims at offering a new fluorescence benzothiadiazole derivative with output characteristics and the wavelength range effective in good laser oscillation equipment, a solar battery with high photoelectric conversion efficiency, etc., the liquid crystal constituent which contains this benzothiadiazole derivative as fluorescence matter, and the liquid crystal device using this again.

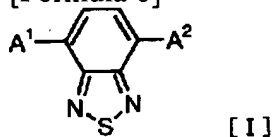
[0011] This invention aims at offering the optoelectric transducer which used this for the organic EL device which used the still more useful new fluorescence benzothiadiazole derivative as a liquid crystallinity organic photo conductor, and this benzothiadiazole derivative, the optoelectric transducer and the liquid crystallinity charge transportation ingredient, and the list.

[0012]

[Means for Solving the Problem] The benzothiadiazole derivative of this invention is expressed with the following general formula [I].

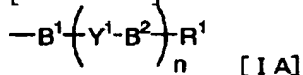
[0013]

[Formula 6]

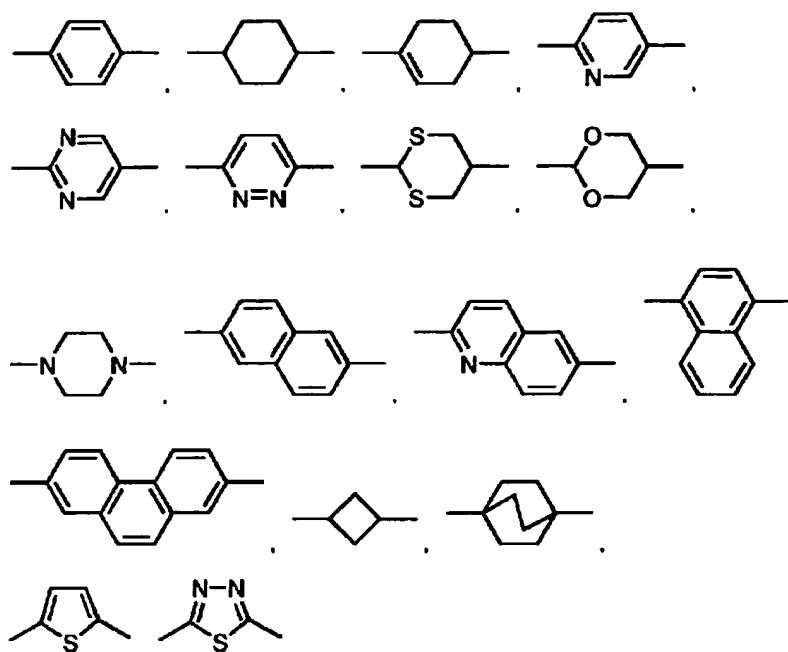


[0014] (A1 and A2 show independently the radical expressed with the following general formula [IA] among a [general formula I] type, respectively.)

[Formula 7]



(The inside of a general formula [IA], and B1 and B-2 are [Formula 8] independently, respectively.)

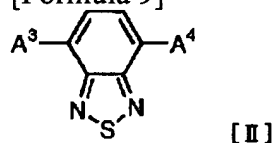


Each of examples and these may have a fluorine atom, a chlorine atom, a bromine atom, a methyl group, the methoxy group, the hydroxyl group, the cyano group, or the nitro group as a substituent. Y1 shows direct coupling or -COO-, -OCH₂-, -CH=N-, -CH=CH-, -C**C-, -O-, -COS-, -CON-, or -N=N-. n shows 0 or 1. The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 by which R1 may be permuted by the halogen atom, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, either of the alkylthio groups of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching, the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching is shown.)

[0015] The liquid crystal constituent of this invention is characterized by including at least one or more sorts of benzothiadiazole derivatives expressed with the following general formula [II].

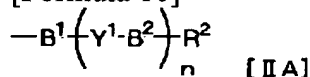
[0016]

[Formula 9]



[0017] (A3 and A4 show independently the radical expressed with the following general formula [IIA] among a general formula [II], respectively.)

[Formula 10]



(B1, B-2, and Y1 and n are synonymous also in a general formula [IA] among a general formula [IIA]. R2) The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the hydrogen atom, the halogen atom, and the halogen atom, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, either of the alkylthio groups of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching, the shape of a straight chain of the carbon numbers 1-20 which may be

permuted by the halogen atom, and branching is shown.)

[0018] The liquid crystal constituent of this invention is preferably set to said general formula [IIA]. The alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 by which R2 may be permuted by the halogen atom, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, The alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching, Or it is the alkylthio group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, and it is desirable to contain at least one or more sorts of benzothiadiazole derivatives which are expressed with said general formula [II], and have liquid crystallinity especially.

[0019] As a result of inquiring wholeheartedly that this invention persons should solve many above-mentioned problems, a specific benzothiadiazole derivative namely, as fluorescence dichroism coloring matter That high dichroism and high solubility are shown to a liquid crystal ingredient and 4, 7-permutation - The specific benzothiadiazole derivative which has 2, 1, and 3-benzothiadiazole ring shows liquid crystallinity. And it is 4 and 7-permutation about a negative big dielectric anisotropy useful to the electro-optical effect of a liquid crystal device etc. - A header and this invention were completed for what 2, 1, and 3-benzothiadiazole ring shows.

[0020] The benzothiadiazole derivative or liquid crystal constituent of this invention has high fluorescence dichroism, and is useful to various liquid crystal display components, a wavelength sensing element, an electroluminescent element, a charge transportation ingredient, and the optoelectric transducer using this.

[0021] The liquid crystal display component of this invention is characterized by pinching such a liquid crystal constituent between electrode substrates at least with transparent one side.

[0022] It is using-benzothiadiazole derivative [of this invention], or liquid crystal constituent of this invention characterized by the wavelength sensing element of this invention.

[0023] It is using-benzothiadiazole derivative [of this invention], or liquid crystal constituent of this invention characterized by the electroluminescent element of this invention.

[0024] The charge transportation ingredient of this invention is characterized by using the benzothiadiazole derivative of this invention, or the liquid crystal constituent of this invention.

[0025] It is using-this charge transportation ingredient characterized by the optoelectric transducer of this invention.

[0026]

[Embodiment of the Invention] The gestalt of the operation of this invention to the following is explained to a detail.

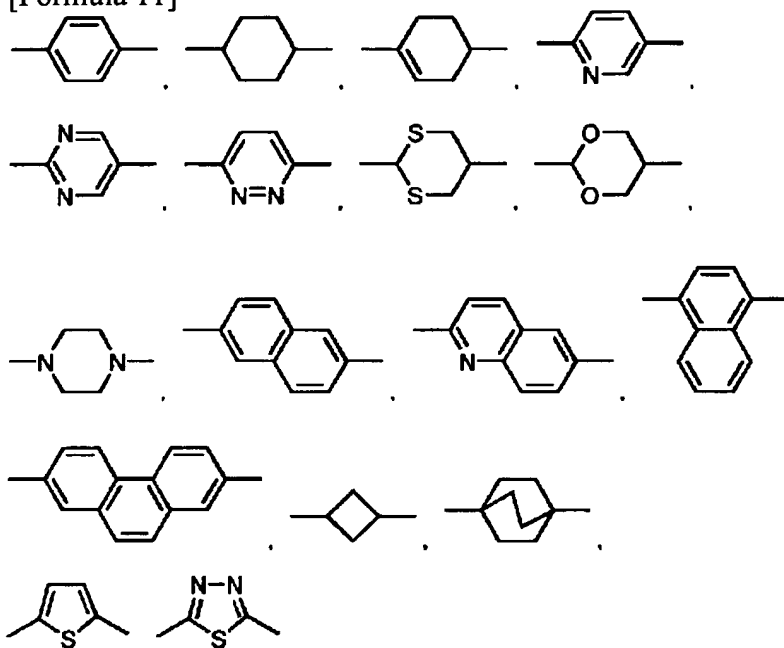
[0027] In the benzothiadiazole derivative of this invention, as R1 in a general formula [I] A methyl group, an ethyl group, n-propyl group, an iso-propyl group, n-butyl, t-butyl, a pentyl radical, a hexyl group, a heptyl radical, an octyl radical, the carbon numbers 1-20, such as a nonyl radical, -- desirable -- the alkyl group; methoxy group of carbon numbers 1-12 -- An ethoxy radical, n-propoxy group, an iso-propoxy group, an n-butoxy radical, the carbon numbers 1-20 corresponding to the above-mentioned alkyl groups, such as a t-butoxy radical, -- desirable -- the alkoxy group; methoxymethyl radical of carbon numbers 1-12 -- A methoxy ethyl group, methoxy butyl, an ethoxy methyl group, an ethoxyethyl radical, the carbon numbers 2-20, such as ethoxy butyl, -- desirable -- the alkoxyalkyl group; methylthio radical of carbon numbers 2-12 -- An ethyl thio radical, n-propyl thio radical, an iso-propyl thio radical, n-butyl thio radical, t-butyl thio radical, a pentyl thio radical, a hexyl thio radical, a heptyl thio radical, the carbon numbers 1-20, such as an octylthio radical and a nonyl thio radical, -- desirable -- the alkylthio group; difluoromethyl group of carbon numbers 1-12 -- The carbon numbers 1-20, such as a trifluoro ethyl group and a pentafluoro pentyl radical, the halogenation alkyl group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkyl group of carbon numbers 1-12; A trifluoroethoxy radical, The carbon numbers 1-20, such as a difluoroethoxy radical, the halogenation alkoxy group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkoxy group of carbon numbers 1-12; A trifluoro methoxymethyl radical, A pentafluoro ethoxy methyl group,

a perfluoro propoxy methyl group, A perfluoro butoxy methyl group, a perfluoro pentyloxy ethyl group, The carbon numbers 2-20, such as methoxy perfluoro butyl and ethoxy perfluoro butyl, the halogenation alkoxyalkyl group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkoxyalkyl group of carbon numbers 2-12; A trifluoro methylthio radical, The carbon numbers 1-20, such as a pentafluoro ethyl thio radical and a perfluoro propyl thio radical, and the halogenation alkylthio group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkylthio group of carbon numbers 1-12 are mentioned. Especially, the straight chain-like alkoxy group of carbon numbers 2-10 is mentioned preferably, and the straight chain-like alkoxy group of carbon numbers 3-8 is mentioned still more preferably.

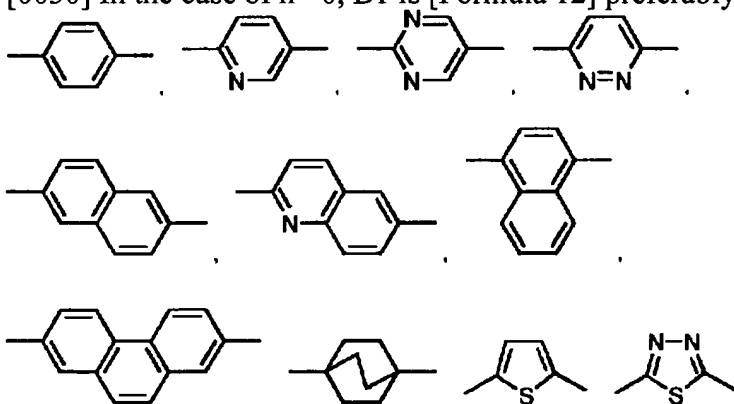
[0028] B1 And B-2 If it carries out, the following connection radical is mentioned independently, respectively.

[0029]

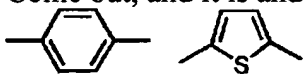
[Formula 11]



[0030] In the case of $n=0$, B1 is [Formula 12] preferably.

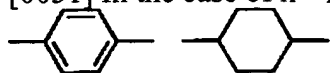


Come out, and it is and is [Formula 13] still more preferably.



It comes out.

[0031] In the case of $n = 1$, B-2 is [Formula 14] preferably.



It comes out.

[0032] Each of these [B1] and B-2s may have a fluorine atom, a chlorine atom, a bromine atom, a methyl group, the methoxy group, the hydroxyl group, the cyano group, or the nitro group as a substituent.

[0033] They are [whether it is direct coupling or Y1 is -COO-, -OCH2-, -CH=N-, -CH=CH-, -C**C-, -O-, -COS-, -CON-, or -N=N-, and is direct coupling preferably, and] -COO- and -OCH2-.

[0034] In the liquid crystal constituent of this invention, as R2 in a general formula [IIA] Hydrogen atom; Halogen atom; methyl groups, such as a fluorine atom, a chlorine atom, and a bromine atom, An ethyl group, n-propyl group, an iso-propyl group, n-butyl, t-butyl, the carbon numbers 1-20, such as a pentyl radical, a hexyl group, a heptyl radical, an octyl radical, and a nonyl radical, -- desirable -- the alkyl group; methoxy group of carbon numbers 1-12 -- An ethoxy radical, n-propoxy group, an iso-propoxy group, an n-butoxy radical, the carbon numbers 1-20 corresponding to the above-mentioned alkyl groups, such as a t-butoxy radical, -- desirable -- the alkoxy group; methoxymethyl radical of carbon numbers 1-12 -- A methoxy ethyl group, methoxy butyl, an ethoxy methyl group, an ethoxyethyl radical, the carbon numbers 2-20, such as ethoxy butyl, -- desirable -- the alkoxyalkyl group; methylthio radical of carbon numbers 2-12 -- An ethyl thio radical, n-propyl thio radical, an iso-propyl thio radical, n-butyl thio radical, t-butyl thio radical, a pentyl thio radical, a hexyl thio radical, a heptyl thio radical, the carbon numbers 1-20, such as an octylthio radical and a nonyl thio radical, -- desirable -- the alkylthio group; difluoromethyl group of carbon numbers 1-12 -- The carbon numbers 1-20, such as a trifluoro ethyl group and a pentafluoro pentyl radical, the halogenation alkyl group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkyl group of carbon numbers 1-12; A trifluoroethoxy radical, The carbon numbers 1-20, such as a difluoroethoxy radical, the halogenation alkoxy group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkoxy group of carbon numbers 1-12; A trifluoro methoxymethyl radical, A pentafluoro ethoxy methyl group, a perfluoro propoxy methyl group, A perfluoro butoxy methyl group, a perfluoro pentyloxy ethyl group, The carbon numbers 2-20, such as methoxy perfluoro butyl and ethoxy perfluoro butyl, the halogenation alkoxyalkyl group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkoxyl alkyl group of carbon numbers 2-12; A trifluoro methylthio radical, The carbon numbers 1-20, such as a pentafluoro ethyl thio radical and a perfluoro propyl thio radical, and the halogenation alkylthio group by which halogen atoms, such as a fluorine atom, were preferably permuted by the alkylthio group of carbon numbers 1-12 are mentioned. Especially, the straight chain-like alkoxy group of carbon numbers 2-10 is mentioned preferably, and the straight chain-like alkoxy group of carbon numbers 3-8 is mentioned still more preferably.

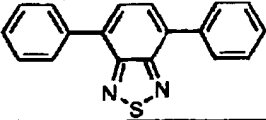
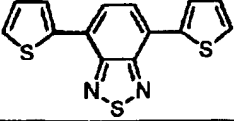
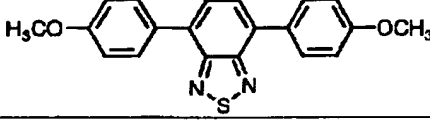
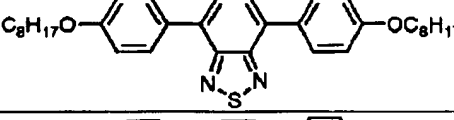
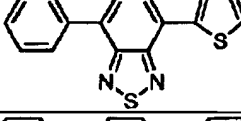
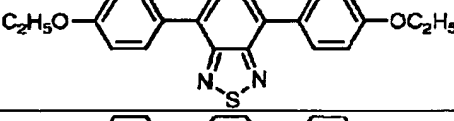
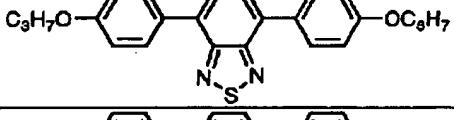
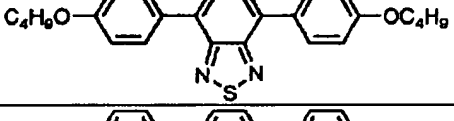
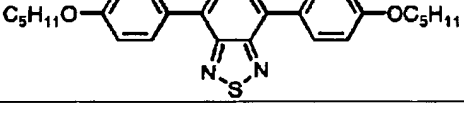
[0035] B1, B-2, and Y1 and n are synonymous also in a general formula [IA] among a general formula [IIA].

[0036] In addition, the alkyl group of the shape of the shape of a straight chain of the carbon numbers 1-20 by which R2 in a general formula [IIA] may be permuted by the halogen atom from a viewpoint of the liquid crystallinity of a compound, and branching, The alkoxy group of the shape of the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching, It is desirable that it is the alkylthio group of the shape of the alkoxyalkyl group of the shape of the shape of a straight chain of the carbon numbers 2-20 which may be permuted by the halogen atom, and branching or the shape of a straight chain of the carbon numbers 1-20 which may be permuted by the halogen atom, and branching.

[0037] Although the example of the benzothiadiazole derivative shown by the general formula [I] and general formula [II] which are used by this invention is shown in following Table 1 and 2, this invention is not limited to the following at all.

[0038]

[Table 1]

[I - 1]	
[I - 2]	
[I - 3]	
[I - 4]	
[I - 5]	
[I - 6]	
[I - 7]	
[I - 8]	
[I - 9]	

[0039]

[Table 2]

[I - 1 0]	
[I - 1 1]	
[I - 1 2]	
[I - 1 3]	
[I - 1 4]	
[I - 1 5]	
[I - 1 6]	
[I - 1 7]	
[I - 1 8]	

[0040] In addition, the benzothiadiazole derivative shown in a general formula [I] and a general formula [II] can be manufactured by the approach according to an approach given in the below-mentioned example, or these.

[0041] The liquid crystal constituent of this invention may not contain two or more sorts of benzothiadiazole derivatives expressed with a general formula [II], and may contain other fluorescence dichroism coloring matter and dichroism coloring matter in the range which does not spoil the effectiveness of this invention.

[0042] The liquid crystal constituent of this invention containing at least one or more sorts of benzothiadiazole derivatives shown by said general formula [II] contains the liquid crystallinity matter in which a liquid crystal phase is shown. The liquid crystallinity matter may be used choosing it from the well-known matter, and when the benzothiadiazole derivative shown by said general formula [II] shows liquid crystallinity, it does not need to contain other liquid crystallinity matter. Polymer liquid crystals, such as low-molecular liquid crystal and principal chain mold macromolecule system liquid crystal in which a phase with well-known nematic phase, cholesteric phase, smectic phase, discotic phase, etc. is shown as a class of liquid crystal phase, side-chain mold macromolecule system liquid crystal, and polymerization nature monomer liquid crystal, can be used.

[0043] When using the well-known liquid crystallinity matter, the compound or mixture of various low-molecular systems, such as; "liquid crystal device handbook" Nihon Kogyo Shimbun for 142nd

committee of Japan Society for the Promotion of Science (1989), 152nd page - the 192nd page and; "liquid crystal handbook" Maruzen Co., Ltd. for liquid crystal handbook edit committees (2000), a biphenyl system that is indicated by 260th page - the 330th page, a phenylcyclohexane system, a phenyl pyrimidine system, and a cyclohexyl cyclohexane system, can specifically be used. Moreover, a macromolecule system compound or mixture which is indicated by; "liquid crystal handbook" Maruzen Co., Ltd. for liquid crystal handbook edit committees (2000) and 365th page - the 415th page can also be used.

[0044] Various additives, such as a chiral dopant, may usually be included in this liquid crystal constituent of this invention about 0.1 to 30% of the weight with the content in a liquid crystal constituent in the range which does not spoil the liquid crystallinity of a liquid crystal constituent.

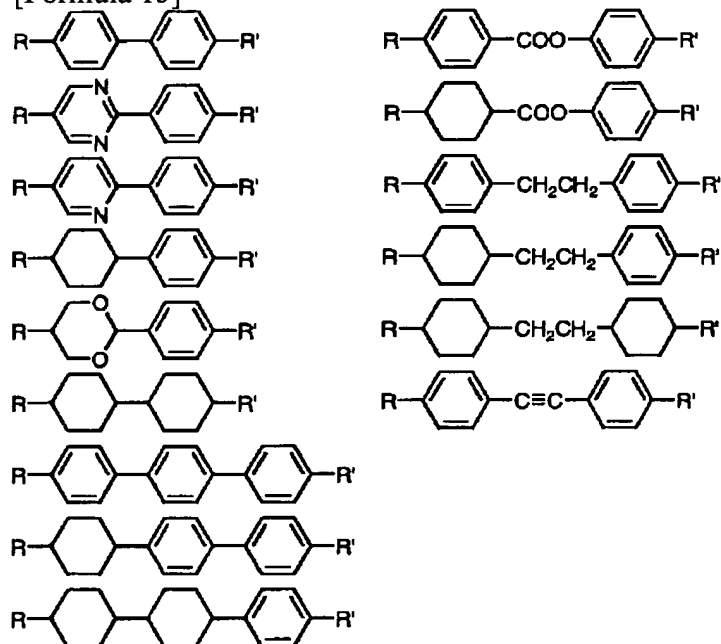
[0045] As a content of the benzothiadiazole derivative in the liquid crystal constituent of this invention expressed with said general formula [II], it is usually 0.1 - 5 % of the weight preferably 0.01 to 30% of the weight to the liquid crystallinity matter.

[0046] The liquid crystal constituent of this invention can be easily obtained by mixing and dissolving the various additives added the liquid crystallinity matter, a benzothiadiazole derivative, and if needed by actuation of shaking etc.

[0047] In this invention, although what is illustrated below is mentioned as a well-known compound desirable as liquid crystallinity matter used for a liquid crystal display component, this invention is not limited to the following at all.

[0048]

[Formula 15]



[0049] the inside of each above-mentioned formula, and R -- the alkyl group of carbon numbers 1-10, an alkoxy group, and an alkoxyalkyl group -- An alkenyl radical is expressed. R' Halogen atom; fluorine atoms, such as a cyano group; fluorine atom and a chlorine atom, The permutation alkyl group of the carbon numbers 1-10 which have halogen atoms, such as a chlorine atom, as a substituent, a permutation alkoxy group, a permutation alkoxyalkyl group, the alkyl group of the permutation alkenyl radical; carbon numbers 1-10, an alkoxy group, an alkoxyalkyl group, and an alkenyl radical may be expressed, and each phenyl group may have the substituent of a cyano group, a fluorine atom, and a chlorine atom.

[0050] the enantio which shows well-known phases, such as a nematic phase, a cholesteric phase, and a smectic phase, as a class of the liquid crystal phase when the liquid crystal constituent of this invention contains the benzothiadiazole derivative which is shown by said general formula [II] and has liquid crystallinity -- fatty tuna -- pick liquid crystal -- or -- mono--- fatty tuna -- pick liquid crystal is

mentioned. As long as a liquid crystal phase is shown as a constituent, in the case of the mixture containing two or more benzothiadiazole derivatives, two or more benzothiadiazole derivatives which have liquid crystallinity may be contained, and it may contain various additives which do not have liquid crystallinity, such as a benzothiadiazole derivative and a charge transportability ingredient.

[0051] As concentration of the benzothiadiazole derivative which has the liquid crystallinity in this liquid crystal constituent of this, it is usually 80 - 100 % of the weight preferably 50 to 100% of the weight to the whole constituent.

[0052] In addition, the liquid crystal constituent containing the benzothiadiazole derivative which is expressed with a general formula [II] and has liquid crystallinity may contain the still better known liquid crystallinity matter. The concentration of the benzothiadiazole derivative in a constituent is usually preferably good at 0.1 - 5 % of the weight, when the well-known liquid crystallinity matter is included 0.01 to 30% of the weight to the liquid crystallinity matter as mentioned above.

[0053] The liquid crystal constituent of this invention has a nematic phase, a cholesteric phase, and a desirable smectic phase, in order to use it for the liquid crystal display component of an electric field effect mold, and especially its nematic phase is desirable.

[0054] The prepared liquid crystal constituent Thus,; "liquid crystal device handbook" Nihon Kogyo Shimbun for 142nd committee of Japan Society for the Promotion of Science (1989), DS mode given in 307th page - the 378th page etc., GH mode, TN mode, At least one side which processed so that the electro-optical effects, such as STN mode, ECB mode, and phase transition mode, might be acquired makes it pinch between transparent electrode substrates. ; "liquid crystal device handbook" Nihon Kogyo Shimbun for 142nd committee of Japan Society for the Promotion of Science (1989), Various liquid crystal display components can be obtained by combining the active drive method by active elements indicated by 387th page - the 434th page etc., such as various direct-drive methods and a thin film transistor.

[0055] In the light wave length sensing element of this invention, when using the liquid crystal constituent of this invention, it is desirable to consider as the constituent containing the principal chain mold macromolecule system liquid crystal, side-chain mold macromolecule system liquid crystal, and polymerization nature monomer liquid crystal other than the above-mentioned low-molecular liquid crystal.

[0056] The wavelength sensing element using the benzothiadiazole derivative or liquid crystal constituent of this invention, Various components, such as an optoelectric transducer and an electroluminescent element, are obtained as the above-mentioned liquid crystal display component and a component pinched between substrates by the same approach, and also By well-known technique, such as carrying out rubbing of the polyimide orientation film, after performing processing which carries out orientation of the liquid crystal on a substrate, in the case of the liquid crystal constituent using giant-molecule system liquid crystal, it can apply, and a liquid crystal constituent can be thin-film-ized, and it can form a component. The benzothiadiazole derivative or liquid crystal constituent applied on the benzothiadiazole derivative or liquid crystal constituent furthermore pinched between substrates, or the substrate can be separated from a substrate, and a film or various tabular components can also be obtained. Also in the liquid crystal constituent using polymerization nature monomer liquid crystal, it is separable from a substrate by carrying out the polymerization of the liquid crystallinity matter in the condition of having held between substrates or on the substrate like the above.

[0057] The liquid crystal display component of this invention can be considered as the configuration shown in drawing 1 . Drawing 1 is the rough sectional view showing the gestalt of operation of the liquid crystal display component of this invention.

[0058] A transparent electrode 3 is formed in one plate surface of a substrate (transparence substrate) 2, and a transparent electrode 5 is formed in one plate surface of a substrate 7 through the reflective film 6. Substrates 2 and 7 are arranged so that transparent electrodes 3 and 5 may meet, and the liquid crystal constituent 4 of this invention is poured in between both the substrates 2 and 7. The front light system 1 which has UV light front light 8 for excitation is arranged at the optical exposure side side of a substrate 2.

[0059] Moreover, the wavelength sensing element of this invention can be considered as the configuration shown in drawing 2. Drawing 2 is the rough schematic diagram showing the gestalt of operation of the wavelength sensing element of this invention, and shows what was used as a wavelength conversion layer of a flexible amorphous-silicon solar cell.

[0060] A metal electrode 13 is formed on the plastic plate 12 with which the laminating of the protection film 11 was carried out to the rear face as a background member, the coloring matter thin film 17 for wavelength conversion which becomes the protection film 18 used as the exposure side of light from the liquid crystal constituent of this invention is formed, and, as for this solar battery, the amorphous silicon 14 as a generation-of-electrical-energy component is formed between the surface member in which the transparent electrode 15 was formed through the collector 16, and flesh-side surface part material.

[0061]

[Example] Although an example and the example of a comparison explain this invention concretely below, this invention is not restrained by the following examples unless the summary is exceeded.

[0062] [I-3]:4 of the example 1 aforementioned table 1, 7-screw (4-methoxypheny) - 1, 2, and 3-benzothiadiazole was compounded.

[0063] The bottom of an argon ambient atmosphere, 4, 7-dibromo - The 2M-sodium-carbonate water solution (150ml) was added to 1, 2, 3-benzothiadiazole (20g), and the benzene solution (300ml) of tetrakis(triphenyl phosphine)palladium (2.7g).

[0064] Stirring mixture well, the ethanol solution (75ml) of 4-methoxypheny boron acid (31g) was dropped over 3 minutes, and heating reflux was carried out for 24 hours.

[0065] Iced water was filled with the reaction mixture after reaction termination, and chloroform extracted. The organic layer was dried with magnesium sulfate after washing with saturation brine. It distills off under reduced pressure of a solvent, the remainder is recrystallized twice in ethanol, and it is 4 and 7-screw (4-methoxypheny). - 1, 2, and 3-benzothiadiazole (17.2g) was obtained.

[0066] The analysis result of a product is as follows.

Green Needles(C₂H₅OH) mp 209-210 **IR 3012, 2832, 1607, 1517, 1478, 1282, 1250, 1179, 1118, and 10291 H-NMR 3.90 (s, 6H), 7.09 (d, 4H, J = 8.9 Hz) 7.72 (s, 2H), 7.93(d, 4H, J=8.9 Hz) MS (70 eV) 348(M⁺) UV (CH₂Cl₂) (log e) 408(4.06) Emission solution(CH₂Cl₂) 542 nmEmission solid 509 nm

[0067] [I-4]:4 of the example 2 aforementioned table 1, 7-screw (4-octyloxy phenyl) - 1, 2, and 3-benzothiadiazole was compounded.

[0068] The bottom of an argon ambient atmosphere, 4, 7-dibromo - The 2M-sodium-carbonate water solution (15ml) was added to 1, 2, 3-benzothiadiazole (1000mg), and the benzene solution (30ml) of tetrakis(triphenyl phosphine)palladium (67.2mg).

[0069] Stirring mixture well, the ethanol solution (7.5ml) of 4-octyloxy phenyl boron acid (2550mg) was dropped over 3 minutes, and heating reflux was carried out for 24 hours.

[0070] Iced water was filled with the reaction mixture after reaction termination, and chloroform extracted. The organic layer was dried with magnesium sulfate after washing with saturation brine. It distills off under reduced pressure of a solvent, the remainder is carried out on a silica gel column chromatography, and it is 4 and 7-screw (4-octyloxy phenyl). - 1, 2, and 3-benzothiadiazole (1.22g) was obtained.

[0071] This compound showed smectic liquid crystallinity in 93.9-152 degrees C.

[0072] The analysis result of a product is as follows.

Green plates(C₂H₅OH) mp 93-94 **IR 2922, 2854, 1606, 1517, 1474, 1277, 1252, 1181, 1028, 998, and 8201 H-NMR 1.30 (t, 6H, J = 7.6), 1.51-1.63 (m, 20H), 1.82 (dt, 4H, J = 6.9, 6.6 Hz), 4.05 (t, 4H, J = 6.6 Hz) 7.07 (d, 4H, J = 8.9 Hz), 7.12 (s, 2H), 7.91(d, 4H, J= 8.9 Hz) MS (70 eV) 544(M⁺) UV (CH₂Cl₂) (log e) 412(4.08) Emission solution(CH₂Cl₂) 546 nmEmission solid 511 nm

[0073] The dielectric anisotropy used as a principal component mixed and dissolved the fluorine-liquid-crystal nature matter marketed by the example 3 aforementioned table 1 considering benzothiadiazole derivative [I-3]5mg of a publication as trade name ZLI-4792 (Merck Japan make) in 1g of forward liquid crystal mixture, and liquid crystal constituent-I was prepared.

[0074] This liquid crystal constituent-I was injected into the cel which polyimide system resin was made

to counter so that it may consist of a glass plate with a transparent electrode by which homogeneous orientation processing was carried out by carrying out rubbing after spreading hardening and that orientation processing side may become antiparallel, and liquid crystal display component-I was produced. For this component, polarization parallel to the direction of rubbing which made the halogen lamp the light source, and perpendicular polarization were irradiated, respectively, and the transparency absorption light spectrum (A parallel and A perpendicular) was measured. The dichroism (order parameter) in transparency absorption was computed by the bottom type using these values.

Dichroism (order parameter: S value) = $(A_{\text{parallel}} - A_{\text{perpendicular}}) / \text{in transparency absorption } (A_{\text{parallel}} + 2 \times A_{\text{perpendicular}})$

[0075] Next, polarization parallel to the direction of rubbing which made the black light fluorescent lamp the excitation light source at liquid crystal display component-I, and perpendicular polarization were irradiated, respectively, and the excitation emission spectrum (E parallel and E perpendicular) was measured. The order parameter in excitation luminescence was computed by the bottom type using these values.

Dichroism (order parameter: S value) = $(E_{\text{parallel}} - E_{\text{perpendicular}}) / \text{in excitation luminescence } (E_{\text{parallel}} + 2 \times E_{\text{perpendicular}})$

[0076] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 3.

[0077] The dielectric anisotropy used as a principal component mixes and dissolves the fluorine-liquid-crystal nature matter marketed by the example 4 aforementioned table 1 considering benzothiadiazole derivative [I-3] 5mg of a publication as trade name MLC-2039 (Merck Japan make) in 1g of negative liquid crystal mixture, and it is a liquid crystal constituent. - II was prepared. This liquid crystal constituent - II is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - II was produced. This liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of II were measured by the same approach as an example 3, and dichroism was computed.

[0078] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 3.

[0079] The dielectric anisotropy used as a principal component mixes and dissolves the fluorine-liquid-crystal nature matter marketed by the example 5 aforementioned table 1 considering benzothiadiazole derivative [I-4] 5mg of a publication as trade name ZLI-4792 (Merck Japan make) in 1g of forward liquid crystal mixture, and it is a liquid crystal constituent. - III was prepared. This liquid crystal constituent - III is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - III was produced. This liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of III were measured by the same approach as an example 3, and dichroism was computed.

[0080] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 3.

[0081] The dielectric anisotropy used as a principal component mixes and dissolves the fluorine-liquid-crystal nature matter marketed by the example 6 aforementioned table 1 considering benzothiadiazole derivative [I-4] 5mg of a publication as trade name MLC-2039 (Merck Japan make) in 1g of negative liquid crystal mixture, and it is a liquid crystal constituent. - IV was prepared.

[0082] This liquid crystal constituent - IV is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - IV was produced. This liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of IV were measured by the same approach as an example 3, and dichroism was computed.

[0083] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 3.

[0084] The dielectric anisotropy used as a principal component mixed the fluorine-liquid-crystal nature matter marketed considering 5mg of fluorescence coloring matter marketed as example of comparison 1 coumarin 6 (SIG made in marl DORITCHI Japan) as trade name ZLI-4792 (Merck Japan make) into 1g of forward liquid crystal mixture, and liquid crystal constituent-V was prepared. However, since the solubility over this liquid crystal mixture of a coumarin 6 was low and the non-dissolved coloring matter crystal arose, filtration for separating a crystal was performed.

[0085] This liquid crystal constituent-V was injected into the homogeneous orientation cel by the same approach as said example 3, and liquid crystal display component-V was produced. The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of this liquid crystal display component-V were measured by the same approach as an example 3, and dichroism was computed.

[0086] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed low dichroism compared with the example 3 and the example 5 as they were shown in Table 3.

[0087] The dielectric anisotropy used as a principal component mixed the fluorine-liquid-crystal nature matter marketed considering 5mg of fluorescence coloring matter marketed as example of comparison 2 coumarin 6 (SIG made in marl DORITCHI Japan) as trade name MLC-2039 (Merck Japan make) into 1g of negative liquid crystal mixture, and liquid crystal constituent-VI was prepared.

[0088] This liquid crystal constituent-VI was injected into the homogeneous orientation cel by the same approach as said example 3, and liquid crystal display component-VI was produced. The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of this liquid crystal display component-VI were measured by the same approach as an example 3, and dichroism was computed.

[0089] The order parameter in transparency absorption of this liquid crystal constituent and the order parameter in excitation luminescence showed low dichroism compared with the example 4 and the example 6 as they were shown in Table 3.

[0090]

[Table 3]

例	液晶表示 素子種	液晶性物質	蛍光性物質	透過吸収 における オーダーパラメーター	励起発光 における オーダーパラメーター
実施例3	I	ZLI-4792 (商品名)	[I-3]	0.70	0.65
実施例5	III		[I-4]	0.74	0.69
比較例1	V		クマリン6	0.41	0.66
実施例4	II	MLC-2039 (商品名)	[I-3]	0.72	0.71
実施例6	IV		[I-4]	0.73	0.75
比較例2	VI		クマリン6	0.57	0.60

[0091] The dielectric anisotropy used as a principal component is respectively mixed into 1g of forward liquid crystal mixture, makes it dissolve the cyano-liquid-crystal nature matter of an example 7 - 11 derivative [of a publication / benzothiadiazole] [I-1] - [I-5] respectively marketed considering 5mg as a trade name E-8 (Merck Japan make) in said table 1, and it is a liquid crystal constituent. - VII - liquid crystal constituent - XI was prepared.

[0092] This liquid crystal constituent [- XI was produced.] - VII - liquid crystal constituent - XI is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - VII - liquid crystal device This liquid crystal display component - VII - liquid crystal device - The transparency absorption spectrum (A parallel and A perpendicular) of XI was measured by the same approach as an example 3, and dichroism was computed.

[0093] The order parameter in transparency absorption of the liquid crystal constituent of this invention showed good dichroism as it was shown in Table 4.

[0094] The dielectric anisotropy used as a principal component mixes the cyano-liquid-crystal nature matter marketed considering 5mg of fluorescence coloring matter marketed as example of comparison 3 coumarin 6 (SIG made in marl DORITCHI Japan) as a trade name E-8 (Merck Japan make) into 1g of forward liquid crystal mixture, and it is a liquid crystal constituent. - XII was prepared.

[0095] This liquid crystal constituent - XII is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - XII was produced. This liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) of XII was measured by the same approach as an example 3, and dichroism was computed.

[0096] The order parameter in transparency absorption of this liquid crystal constituent showed low dichroism compared with the examples 7-11 of this invention as it was shown in Table 4.

[0097]

[Table 4]

例	液晶表示素子№	蛍光性物質	透過吸収における オーダーパラメーター
実施例7	VII	[I-1]	0.42
実施例8	VII	[I-2]	0.51
実施例9	IX	[I-3]	0.63
実施例10	X	[I-4]	0.74
実施例11	XI	[I-8]	0.48
比較例3	XII	クマリン6	0.22

[0098] The benzothiadiazole compound [I-3] given in the example 12 aforementioned table 1 was injected into the cel with a gap of 5 microns which consists of a glass plate with a transparent electrode in which perpendicular orientation (homeotropic orientation) processing was carried out by spreading hardening of a polyimide system orientation film ingredient, and liquid crystal display component-XIII was produced. the place annealed to 182.6 degrees C after heating to 200 degrees C the benzothiadiazole compound [I-3] which pinched this liquid crystal display component-XIII for the component indicates an isotropic phase to be -- the range of 182.6-141.0 degrees C -- mono--- fatty tuna -- the nematic liquid crystal phase of a pick was shown. Furthermore, in this liquid crystal phase temperature requirement, it was checked that this liquid crystal display component-XIII carries out an electro-optics response by 60Hz square wave impression.

[0099] The dielectric anisotropy used as a principal component is respectively mixed into 1g of negative liquid crystal mixture, makes it dissolve the fluorine-liquid-crystal nature matter of an example 13 - 20 derivative [of a publication / benzothiadiazole] [I-6] - [I-13] respectively marketed considering 5mg as trade name MLC-2039 (Merck Japan make) in said tables 1 and 2, and it is a liquid crystal constituent. - XIV - liquid crystal constituent - XXI was prepared.

[0100] This liquid crystal constituent - XIV - liquid crystal constituent - XXI is injected into a homogeneous orientation cel by the same approach as said example 3, and it is a liquid crystal display component. - The XIV - liquid crystal display component XXI was produced. This liquid crystal display component - XIV - liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of XXI were measured by the same approach as an example 3, and dichroism was computed.

[0101] The order parameter in transparency absorption of the liquid crystal constituent of this invention and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 5.

[0102]

[Table 5]

例	液晶表示 素子No	蛍光性物質	透過吸収における オーダーパラメーター	励起発光における オーダーパラメーター
実施例13	XIV	[I - 6]	0.72	0.71
実施例14	XV	[I - 7]	0.72	0.71
実施例15	XVI	[I - 8]	0.71	0.73
実施例16	XVII	[I - 9]	0.72	0.72
実施例17	XVIII	[I - 10]	0.73	0.73
実施例18	XIX	[I - 11]	0.73	0.72
実施例19	XX	[I - 12]	0.74	0.73
実施例20	XXI	[I - 13]	0.76	0.73

[0103] The dielectric anisotropy used as a principal component is respectively mixed into 1g of negative liquid crystal mixture, makes it dissolve the fluorine-liquid-crystal nature matter of an example 21 - 24 derivative [of a publication / benzothiadiazole] [I-15] - [I-18] respectively marketed considering 5mg as trade name MLC-2039 (Merck Japan make) in said table 2, and it is a liquid crystal constituent-XXII - liquid crystal constituent. - XXV was prepared.

[0104] This liquid crystal constituent-XXII - liquid crystal constituent - XXV was injected into the homogeneous orientation cel by the same approach as said example 3, and the liquid crystal display component-XXII - liquid crystal display component XXV was produced. This liquid crystal display component-XXII - liquid crystal display component - The transparency absorption spectrum (A parallel and A perpendicular) and excitation emission spectrum (E parallel and E perpendicular) of XXV were measured by the same approach as an example 3, and dichroism was computed.

[0105] The order parameter in transparency absorption of the liquid crystal constituent of this invention and the order parameter in excitation luminescence showed good dichroism as they were shown in Table 6.

[0106]

[Table 6]

例	液晶表示 素子No	蛍光性物質	透過吸収における オーダーパラメーター	励起発光における オーダーパラメーター
実施例21	XXII	[I - 15]	0.67	0.69
実施例22	XXIII	[I - 16]	0.65	0.66
実施例23	XXIV	[I - 17]	0.68	0.68
実施例24	XXV	[I - 18]	0.66	0.67

[0107] examples 25-29 -- it blended with said table 1 by the ratio which shows the benzothiadiazole derivative [I-7] of a publication, and [I-9] in Table 7, and liquid crystal constituent-XXVI- liquid crystal constituent-XXX was prepared. This liquid crystal constituent-XXVI - liquid crystal constituent - XXX was pinched between glass substrates, it is a microscope hot stage (METORATOREDO "FP-82"), and after heating to an isotropic condition, it cooled slowly, liquid crystal phase temperature was observed, and the result was shown in drawing 3 .

[0108] The liquid crystal constituent of this invention showed the nematic liquid crystal phase of enantio, and the nematic liquid crystal temperature requirement expanded it most in the example 27 so

that more clearly than drawing 3 .

[0109]

[Table 7]

例	液晶組成物No.	ベンゾチアジアゾール誘導体 配合比(モル重量比)	
		[I -7]	[I -9]
実施例25	XXVI	100	—
実施例26	XXVII	75	25
実施例27	XXVIII	50	50
実施例28	XXIX	25	75
実施例29	XXX	—	100

[0110]

[Effect of the Invention] According to this invention, a new fluorescence benzothiadiazole derivative with good dichroism and a liquid crystal constituent are offered, and the liquid crystal display component which has the outstanding contrast property and a drive property by this can be realized as explained in full detail above. moreover, the thing for which the new liquid crystallinity compound which has fluorescence and dichroism is offered -- the application as a conventional liquid crystal device -- in addition, the outstanding effectiveness that luminescence and an electrical property are realizable also as a wavelength sensing element, an electroluminescent element, and an optoelectric transducer is done so.

[Translation done.]